CLAIMS

1.(Amended) A fuel cell system comprising: a fuel cell; fuel gas supply means for supplying a fuel gas to an anode of said fuel cell; oxidant gas supply means for supplying an oxidant gas to a cathode of said fuel cell; inert gas supply means for supplying an inert gas to the anode and/or cathode of said fuel cell; and means for measuring a pressure Pa in an inlet-side flow path leading to the anode of said fuel cell and a pressure Pc in an inlet-side flow path leading to the cathode,

said fuel cell being subjected to a purge operation of replacing the fuel gas and/or oxidant gas in said fuel cell with the inert gas supplied from said inert gas supply means when said fuel cell is started up or shut down,

wherein said fuel cell system further comprises control means for increasing or decreasing the amount of the inert gas supplied to said fuel cell based on the values of Pa and Pc during the purge operation of said fuel cell, and

wherein the differential pressure $\triangle P$ is defined as $\triangle P = Pa - Pc$, and the differential pressure during operation $\triangle Po$ and the differential pressure during the purge operation $\triangle Pp$ satisfy the relations: $0 < \triangle Po \times \triangle Pp$ and $|\triangle Pp| \leqq |\triangle Po|$.

2.(Deleted)

3.(Deleted)

4.(Amended) The fuel cell system in accordance with claim 1, further comprising means for changing the internal diameter of an outlet-side flow path of an exhaust gas from said fuel cell, and means for changing said internal diameter based on the values of Pa and Pc during the purge operation of said fuel cell.

REPLY
(Translation)

To : Examiner of the Patent Office

1 Identification of the International Application
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5 Subject matter of Reply

(1) Written Opinion states that the inventions as set forth in claims 1 to 2 have neither novelty nor inventive step and that the inventions as set forth in claims 3 and 4 do not have inventive step.

In response to such opinion, claims are amended in Amendment submitted on the same day as this Reply, and the amended claims are described below.

(2) With respect to the invention of claim 1

① In Amendment, the invention as set forth in claim 1 includes the features of claims 2 and 3, and the claim reads as follows:

"A fuel cell system comprising: a fuel cell; fuel gas supply means for supplying a fuel gas to an anode of said fuel cell; oxidant gas supply means for supplying an oxidant gas to a cathode of said fuel cell; inert gas supply means for supplying an inert gas to the anode and/or cathode of said fuel cell; and means for measuring a pressure Pa in an inlet-side flow path leading to the anode of said fuel cell and a pressure Pc in an inlet-side flow path leading to the cathode,

said fuel cell being subjected to a purge operation of replacing the fuel gas and/or oxidant gas in said fuel cell with the inert gas supplied from said inert gas supply means when said fuel cell is started up or shut down,

wherein said fuel cell system further comprises control means for increasing or decreasing the amount of the inert gas supplied to said fuel cell based on the values of Pa and Pc during the purge operation of said fuel cell, and

wherein the differential pressure $\triangle P$ is defined as $\triangle P = Pa - Pc$, and the differential pressure during operation $\triangle Po$ and the differential pressure during the purge operation $\triangle Pp$ satisfy the relations: $0 < \triangle Po \times \triangle Pp$ and $|\triangle Pp| \leqq |\triangle Po|$.

According to the present invention, during operation

and during the purge operation of replacing the fuel gas and/or oxidant gas in the fuel cell with the inert gas, the pressure on one of the anode side and cathode side of the electrolyte membrane is controlled such that it is constantly larger than the pressure on the other side. Therefore, it is possible to suppress degradation of the strength of the solid polymer membrane caused by the vibration thereof which occurs during start-up or shut-down purging.

② The cited reference 1 (JP 2003-168453) describes a fuel cell that is subjected to a purge operation. However, the concept of purging in the present invention is completely different from that of the cited reference.

That is, in the present invention, it is the operation of supplying the inert gas to remove the reactive gas remaining in the stack. In the reference 1, it is the operation of releasing the valve to reduce the pressure inside the stack when the pressure inside the stack exceeds a threshold value.

The reference 1 is silent about the supply of an inert gas in the purge operation. The reference 1 states that the effect produced by the purge is effective utilization of the reactive gas remaining inside the cell. If the techniques of the references 2 and 3 in which the remaining gas is displaced by the inert gas are applied to the technique of the reference 1, the effect of the purge of the reference 1 will be lost. Therefore, there is no motivation for combining the reference 1 with the references 2 and 3, and we believe that the present invention does not correspond to the invention that could be readily obtained by those skilled in the art based on the disclosures of the references 1 to 3.

Further, the reference 1 does not describe the control upon start-up either.

It appears that Written Opinion regards the purge start t1 of the reference 1 as being equivalent to the purge start

of the present invention. However, since the purge start of the present invention is the shut-down of power generation of the fuel cell, Written Opinion is wrong. That is, the power generation shutdown t2 as shown in FIG. 21 of the reference is the timing of the purge start of the present invention.

The reference 1 is silent about the control of the flow rate by purging or the like after t2 of FIG. 21 and t1 of FIG. 22. However, one of the characteristics of the present invention is to control the gas pressure during purging.

That is, although the reference 1 discloses making the differential pressure after power generation shut-down smaller than the differential pressure before shut-down, it is different in the concept of purging from the present invention in which gas is forced to flow after power generation shutdown.

③ Next, the cited reference 2 (JP 63-116373) describes the control of the inert gas during purging. However, FIG. 2 shows that the differential pressure is reversed midway through purging, and FIG. 3 shows that the differential pressure during the operation of the fuel cell and during purging is zero. Hence, the relation of the present invention: $0 < \triangle Po \times \triangle Pp$ is not satisfied.

④ In the cited reference 3 (JP 5-205761), an inert gas is supplied to keep the differential pressure between the gases sealed in the anode and the cathode constant. According to the present invention, the differential pressure of the gases that are flowing is made constant, but in the reference 3, the differential pressure of the gases that are stationary is controlled so as to become constant.

⑤ As described above, the inventions as recited in the references 1 to 3 are different from the present invention, and these references do not even suggest that the combination thereof would lead those skilled in the art to arrive at the present invention.

(3) With respect to the invention of claim 4

Since this claim is dependent on claim 1 as described above, we believe that the rejection applied to the invention of this claim is not appropriate.

6. Conclusion

For the above reasons, we believe that the inventions as set forth in claims 1 and 4 have novelty and inventive step. Therefore, we would like to request an affirmative International Preliminary Examination Report to be prepared with respect to the novelty, the inventiveness, and the industrial applicability of the present invention.